USE CASE

Dry Pump Monitoring Solution Takes the Risk out of Semiconductor Manufacturing

Introduction

Ensuring all process equipment is in tip-top shape is critical to semiconductor manufacturing in pursuing wafer production quality and yield. For example, if the dry pump of the low pressure chemical vapor deposition (LPCVD) system or ion implanter used in the diffusion process provides insufficient vacuum or fails, causing back pressure to push air and foreign particles into the chamber, the entire run of wafers may need to be scrapped. To address these issues, Good Tech Instruments has partnered with ADLINK Technology in developing a dry pump monitoring solution to help semiconductor manufacturers eliminate the risk of unexpected shutdown and optimize equipment management.



Challenges

Conventionally, monitoring systems provided by dry pump suppliers only keep track of conditions such as pressure, flow, temperature and electrical current, but not vibrations. Users do not have access to complete information about the system and thus have difficulty in predicting failure and preventing downtime. Electrical current, for example, is a lagging indicator for dry pumps, as when the current gets too high, the machine can shut down at any time.

With a lack of effective health indicators and precise prediction of product lifetime, users usually return a dry pump to the vendor for servicing once the dry pump has been operating for a predetermined number of hours, regardless of its actual condition. And when the serviced dry pump is returned from the vendor back to the user, the acceptance check is usually based only on electrical current testing; there is no guarantee of third-party maintenance quality.

To reduce the risk of shortened lifetime and bring down overall operation and maintenance costs, users need more comprehensive dry pump health indicators to achieve a more precise estimation of equipment lifetime. This will allow them to develop more preemptive maintenance strategies to ensure wafer delivery and quality yield.

The Solution

To address these industrial pain points, Good Tech Instruments has developed a remote monitoring solution with alarm notifications for dry pumps based on additional assessments of vibrations specified in ISO 10816, broadband value and spectrum overall value (SOV) management, as well as traditional indicators of machine health.

With this system, even without access to an advanced fast Fourier transform (FFT) spectrum analyzer, users are able to discover the most minor signs of equipment failure, such as pitting corrosion (broadband high-frequency vibration) and powder turbulence (low-frequency vibration) that conventional vibration monitoring solutions are unable to ascertain.

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The complex vibrational signals are translated into intuitive indicators allowing for easy review, providing valuable insights into device condition and helping users to spot the most minor signs of equipment failure in the very early stages of development. Users can thus predict equipment health and lifetime more precisely and implement more reactive and responsive management in their efforts to bring down operation and maintenance costs.

The success of this dry pump monitoring system comes from the perfect collaboration of Good Tech's outstanding domain area expertise and the powerful edge computing platform provided by ADLINK, which includes ADLINK's ultra-compact edge computer MCM-100 integrated with data acquisition module as well as software and drivers needed for IoT deployment.

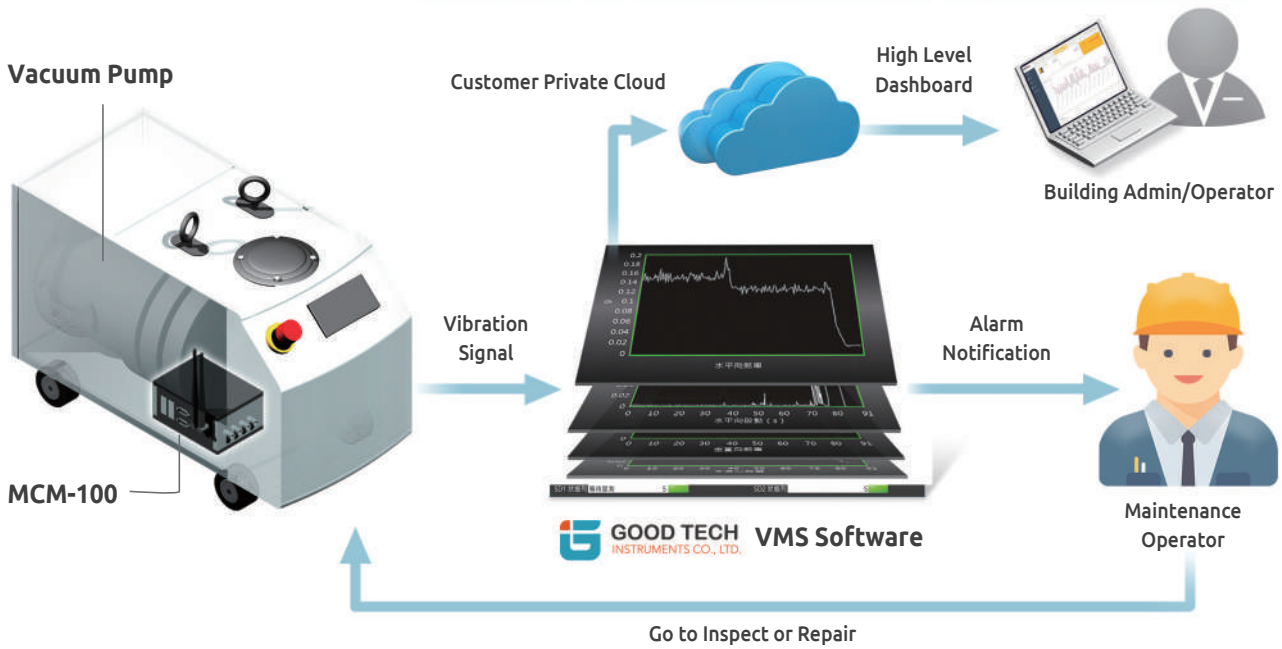
The pre-integrated soft-and-hardware platform combining rich and diverse I/O including USB, COM, Ethernet and 4G provides a complete solution to free Good Tech from the hassles of IT and OT issues and allows them to focus attention on their domain area applications. Each single MCM-100 unit provides 4 channels to connect to 4 axes allowing for simultaneous monitoring of up to 4 dry pumps, with 24-bit resolution and 128kS/s sampling rate, outclassing competing monitoring systems by supporting a wider range of sensor inputs and more precise spectrum analyses.

Customer Benefits

With ADLINK's MCM-100 edge IoT platform, Good Tech is able to realize their equipment monitoring solution in a very effective way, allowing users to ensure wafer delivery and quality yield, reduce the risk of downtime, as well as minimize overall costs of equipment operation and maintenance, resulting in higher return on Investment (ROI) for semiconductor manufacturers.

- ***Preventive maintenance:*** The Good Tech solution provides more comprehensive and advanced indicators for monitoring the health of dry pumps, so that wafer makers can better understand the real status of their equipment and develop predictive/preventive maintenance strategies.
- ***Real time alarms:*** The solution also provides real-time warnings and event alerts to prevent unexpected downtime and associated financial losses on the part of manufacturers.
- ***Optimized equipment management:*** With the ability to better predict equipment lifetime and have more reliable quality check indicators, users can improve their operation and maintenance practices and maximize their ROI.

Architecture Diagram



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