Effective Pump Monitoring

Integrating continuous online pump monitoring with the plant's control system to increase asset availability and prevent lost profits through unplanned downtime. By ***Jonas Berge***, senior PlantWeb consultant, Emerson Process Management

Vibration monitoring is no longer important just for big ticket assets such as turbines and compressors. Motor-pump trains, which service other expensive assets, can halt production if they fail. Fortunately, a fault analysis algorithm for centrifugal pumps, used in combination with Foundation fieldbus and Electronic Device Description Language (EDDL) enables efficient pump monitoring to increase plant up-time with less effort.

Many problems can be missed during the occasional field check for pump vibration. Continuous pump monitoring that reports asset health data to technicians and operators can reduce pump failure and plant downtime.

Plant Challenge

Motor-pump machine trains are the backbone of most process industries and account for a large part of the plant's rotating machinery. Many are essential to maintaining critical production processes. Problems such as bearing wear, shaft misalignment, pump cavitation, imbalance, motor overheating, and overloading can cause a pump-motor train to fail and stop production.

In the past, many plants at best inspected pumps infrequently because they had to be done manually in the field. In situations where pumps are not operating, no condition monitoring data can be collected. Even if online vibration monitoring was used, it was not sufficient to detect problems such as overheating or overloading, or to conclusively determine what was wrong with a pump-motor train.

Most vibration monitoring software has to run on a separate workstation from the plant control system. This works well for one or two package unit assets such as compressors or turbines, which have their own control systems, but using specialised software becomes unwieldy when monitoring numerous pumps. Operators and technicians need the ability to monitor pumps, transmitters, and valves from a single software application.

New Solution

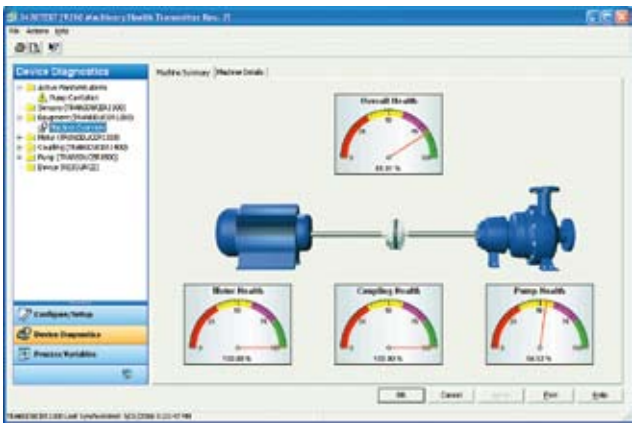
Specialised machinery health transmitters monitor the health of AC induction motor-driven centrifugal pumps allowing integrated, continuous monitoring. This optimised machinery health solution is in a rugged enclosure for field mounting and is ideal for pump applications where turbine monitoring would be more than is required.

This new transmitter makes pump monitoring continuous and automatic instead of infrequent and manual. The device is mounted next to the pump, minimising sensor

wiring. It communicates asset health information to the control room, reducing the need for field inspections. In addition to six vibration sensors, the transmitter also measures motor flux, temperature, and shaft speed. These additional measurements enable more complete and accurate diagnosis of developing problems.

Software in ordinary computers cannot process the hundreds of samples per second collected during vibration monitoring. But diagnostics analytical technology embedded in this machinery health transmitter recognises the symptoms that signify potential problems and quickly communicates them to the plant's control system.

This specialised technology continuously assesses motor-pump train health based on all inputs, produces a health index that summarises detailed diagnostics into an easily understood indicator of overall asset health, and recommends the necessary actions to address any problems.



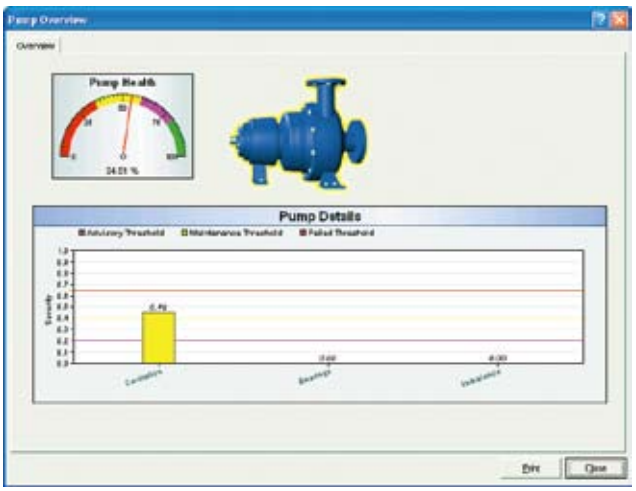
Overview of pump assembly health.

Tightly Integrated

Field data diagnostics collected through a digital plant architecture is the foundation for predictive and efficient maintenance management and leads to improved plant performance. Detailed diagnostics are communicated to the technician's device management software using Foundation fieldbus, which is also employed for its initial setup and configuration.

The machinery health value and other key indicators are available as Analogue Input (AI) function blocks. They can be trended in the control system and compared to process variables such as temperature, pressure, or flow to detect correlation between pump health and operating conditions. Once the operator is aware of a pump condition such as cavitation, the problem may be reduced or eliminated by a simple adjustment.

The content and organisation of the detailed diagnostics as they appear in device management software is decided by a machinery health transmitter using EDDL technology and is displayed consistently in any control system. The IEC 61804-3 EDDL standard is the key to interoperability, ensuring no functionality is lost and that all diagnostics are accessible.

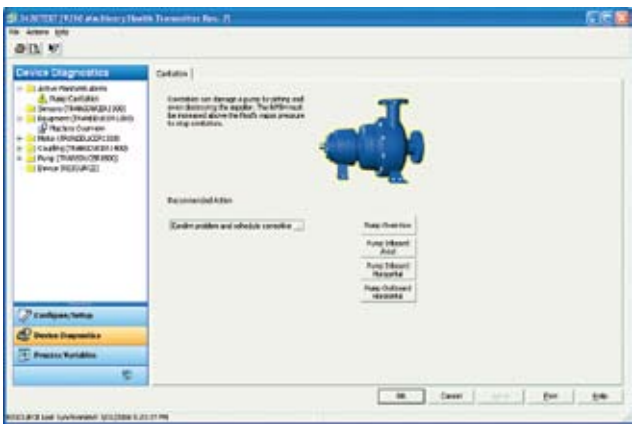


Detailed diagnostics for each component.

EDDL was developed through a cooperative effort between Fieldbus Foundation, HART Communication Foundation, Profibus Nutzerorganisation eV (PNO), and OPC Foundation. Foundation fieldbus has a unique ability to send alerts to both operations and maintenance personnel. The machinery health transmitter and some other Foundation fieldbus devices have the additional ability to prioritise alerts and show the technician which pumps have problems and which do not so they can work on the most critical problems first.

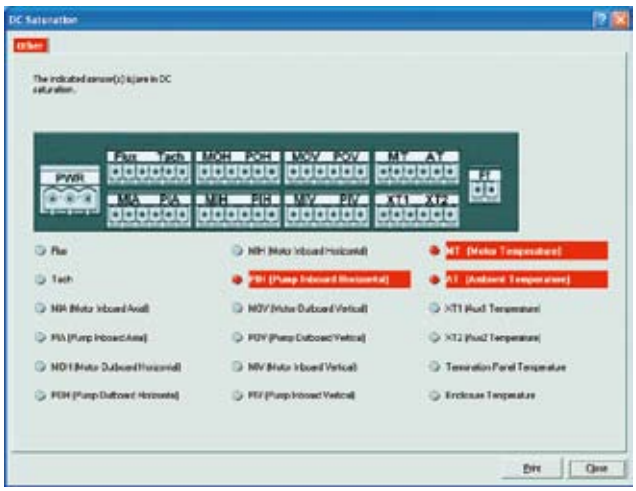
Ease Of Use

The machinery health transmitter communicates diagnostic results for decision-making. EDDL presents the recommended action to be taken through illustrations and rich graphics based on know-how from manufacturer experts.



EDDL recommends action based on manufacturer know-how.

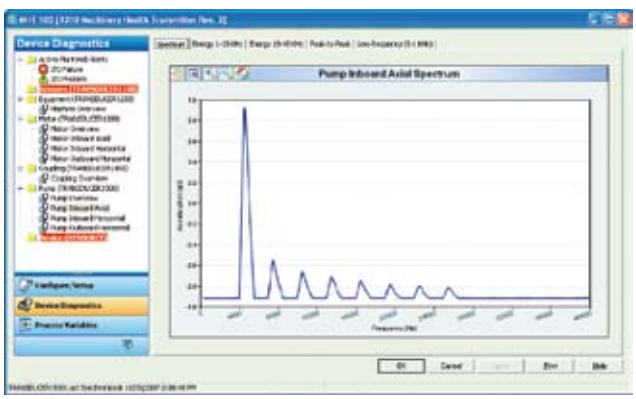
The bewildering amount of diagnostics sent from a sophisticated machinery health transmitter is organised logically by EDDL and displayed in a user friendly way, using a hierarchical tree, tabbed cards, pop-up windows and frames, making the pump assembly easy to troubleshoot on any control system.



Images assist in troubleshooting.

These intuitive graphical displays include images to pinpoint the location of the fault, needle gauges for overall health index, bar graph for cavitation and imbalance, and waveform graph for vibration spectrum.

As problems occur with motor, coupling, or pump, the schematic diagram changes dynamically to indicate the problem area. The user-friendly interface allows the technician to drill down into more detail for each part to determine the problem.



The graph visualises waveforms such as a vibration spectrum.

EDDL allows technicians to use a single software application to diagnose pumps, control valves, radar level transmitter and variable speed drives, reducing the number of programmes they need to know. Enhancing ease of use even further, pumps appear on the screen with the same look and feel as other plant devices. The tools for pan and zoom of the vibration spectrum are the same as those used for any graph or chart and for any device by any manufacturer using any communication protocol for diagnostics or setup.

This consistency makes the EDDL-based software very easy to use. No other technology and no amount of style-guides can provide this level of consistency.

Operators are responsible for the production process and schedule, which sometimes means allowing pumps to operate beyond nominal capacity. By routing alerts to the operator workstations, operators understand how changes in operating set points can positively or negatively impact pump health. Moreover, anytime there is a pump alert, the operator can click to see the pump diagnostics, which enables decision making about the processes and maintenance.

Without this feature, operators would have to switch between different systems. Experience shows that when there are different workstation requiring separate logons, etc, the diagnostic system will fall into disuse and predictive maintenance practices will end. Because an EDDL file is not software, this third-party device vendor file does not interfere with the run time robustness of the control system and enables complete integration of the device management software.

The device manufacturer's experts created online help for all parameters and wizards. This support assists technicians with the interpretation of diagnostics and guides them through determining the appropriate actions to address problems. Help is available by clicking on the parameter in question. The device management software also makes the full manual available online.

Implementation

Best-in-class plants predict and avert the break down of vital pumps by using machinery health solutions and reduce maintenance cost and process upsets by delivering accurate, actionable information to the right person in time to make a difference. Through this predictive maintenance approach, pump overhauls can be undertaken only when the need is supported through accurate asset health diagnostics.

Those plants that had the vision to invest in Foundation fieldbus infrastructure can easily adopt this new breed of devices. If you are planning a project now, use fieldbus to build a digital plant architecture that will enable pump monitoring and other innovative solutions. Even in a plant without Foundation fieldbus, it is possible to connect several machinery health transmitters to a fieldbus interface module that acts as a gateway, allowing data to be integrated into legacy systems. In these plants, this is a good way to evaluate both pump monitoring and fieldbus technologies.

Other bus technologies require undue variable mapping and other device integration technologies cannot be used on operator consoles. This new opportunity for integrated online monitoring of pumps provides plants the ability to monitor critical pump health and attain control over the plant processes, and profitability, like never before.

ENQUIRY NO. **2401**