Comprehensive
Fan Monitoring

Maestro

FanMon™ Primary and Booster Mine Fan Monitoring

Extend Fan Life and Improve Underground Air Quality.

Improved real time data means more time at the face.

Maestro Digital Mine

Paradigm shift.

Do you still wait for hand written letters to arrive at your office desk or do you use email service?

Do you wait for manuals to arrive by mail or do you use the Internet to access supplier websites?

So why should you rely and wait on an expensive, fly-in service specialist or by a “walk around” approach whereby a technician uses a hand-held device to collect readings?

FanMon™ is a continuous 24-7 system. Vibration software can be remotely viewed anywhere on the network or even off-site once an alarm threshold is reached. FanMon™ offers relatively inexpensive insurance for avoiding costly failures and can improve the effectiveness with which fan maintenance is planned.

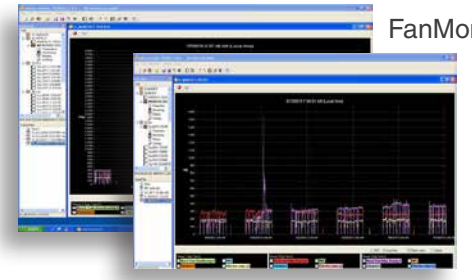
Reduce equipment down time.

No more waiting. No more expensive service travel charges.

FanMon™ Primary and Booster Mine Fan Monitoring

Critical vibration data 24-7

Real time vibration monitoring delivers critical information before almost all fan failures. Hiring a vibration specialist after the event is too late.



FanMon™ is the world's first comprehensive and inexpensive fan monitoring system which is permanently installed on mine primary or booster fans. The data is reliable and repeatable since the sensors are permanently installed and always in the same location. Portable vibration systems are very dependent on sensor location and subject to human error.

FanMon™ can be incorporated into an alarm or safety shutdown system and provides complete vibration analysis including vibration signatures. This analysis or signature interpretation can be viewed locally or across the world by the fan manufacturer or vibration specialist without the need for expensive travel and wait time.

Fan performance in real time

Reliable airflow, air temperature and static or differential pressure measurement is required to measure fan performance. Maestro's digital sensors are stable and repeatable even in dirty, oil misty air with varying humidity and temperature levels.

Eliminate fan imbalance damage

Detecting imbalance early can save large amounts of money. Fan imbalance results in severely reducing bearing and motor life. Unexpected mine downtime and excessive damage can be all but eliminated. Imbalance occurs when the fan blade assembly is not perfectly balanced about the shaft center line. This can occur in the fan manufacturing process (machining errors or casting flaws) or repair process including improper balancing procedures. Other examples are the blades can be subject to erosion or corrosion which causes a reduction of material; debris build up due to shotcrete residue; a loose hub-to-shaft fit or improper and equalized air delivery to the fan inlet zone. Lastly in applications with mine air heaters, differential temperature between the top and bottom of the fan housing can cause imbalance.

An integrated single solution that provides monitoring of fan KPI's along with predictive failure analysis.

Natural resonant frequency protection

Many fans have resonant frequencies below their normal operating speed. Operating at resonant frequencies can cause high vibration levels that, if uncorrected, will cause damage. Depending on which component of the assembly is in resonance, the vibrations can cause a wide range of problems, from annoying noise to destructive failure. Shafts, bearings, and foundations are particularly susceptible to problems with resonance.

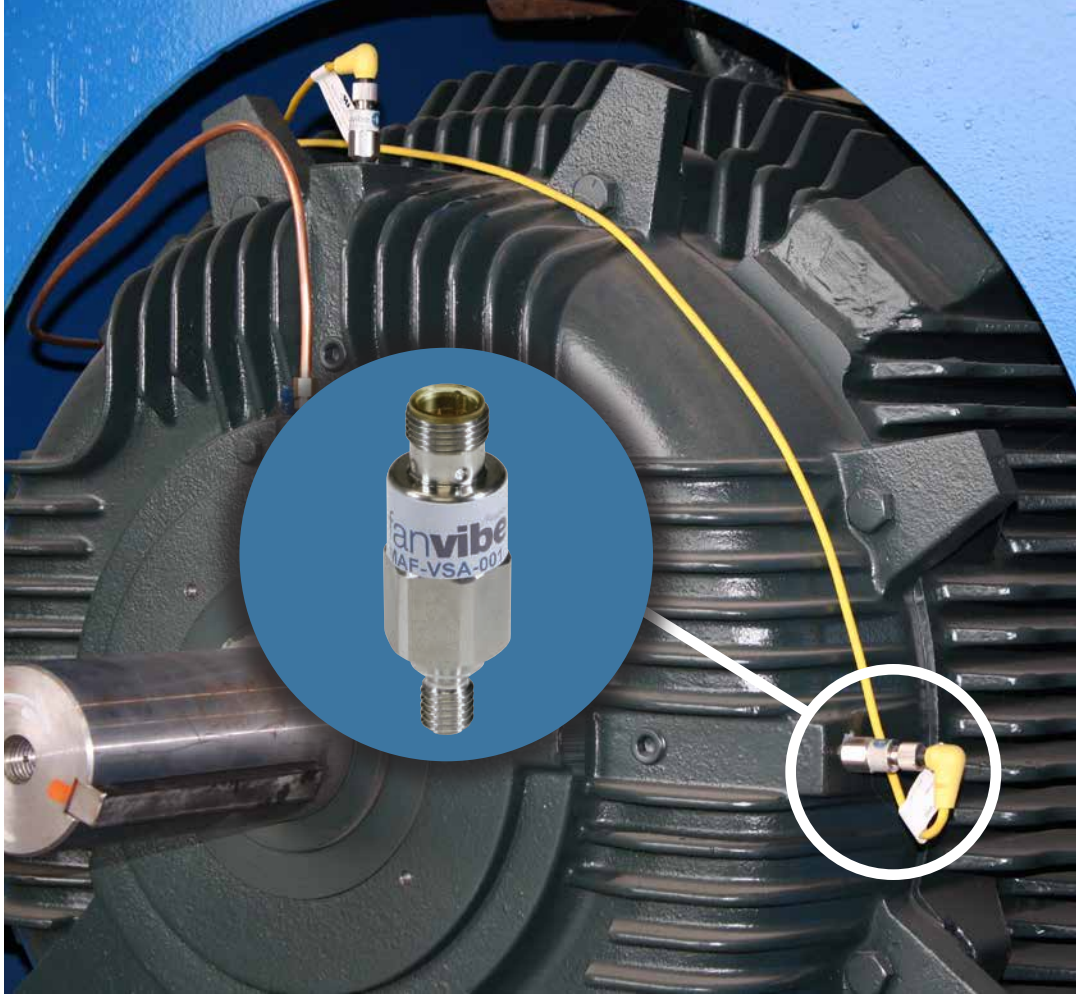
Many new fan motors utilize variable frequency drives to reduce energy consumption. Properly matching fan airflow delivery to mine load requirements reduces the fan's rotational speed. Because slowing a fan increases the risk of encountering one of these conditions, the VFD should be programmed to avoid operating at these frequencies. FanMon™ can help identify the natural frequency of the total installed installation by monitoring the vibration levels while taking the fan through the entire rotation speed range.

Monitor blade frequencies for fatigue

FanMon™ can be configured to monitor frequencies for high cycle blade fatigue.

Each time a blade passes near an obstruction, such as a drive shaft or structural support, blade load fluctuates. This vibration level is a function of the fan's speed and number of blades. If the vibration is at the fan's natural frequency, the amplitude and internal stresses on the blade are greatly increased and can be destructive.

The beam pass frequency is the number of obstructions or beams one blade passes over per revolution while blade pass frequency is the number of times per revolution that a fan tip passes a point on the fan ring expressed in Hz alternately thought of as "how the fan interacts with the structure". FanMon™ can be configured to monitor and alarm on both of these frequencies in real time.



Detect bearing wear before failure

FanMon™ provides full vibration monitoring of all rotational bearings. Configuration of the monitoring system is normally completed before the system is shipped. Alternately, the user can easily configure the fan rotational speed and the manufacturer's bearing DIN numbers into the FanMon™ software configuration package. The software library has most of the popular bearing manufacturer's rotational frequencies or they can be easily calculated by using the bearing dimensions.

Increase motor reliability

Motor stator temperature monitoring is used to locate hot spots or high operating temperatures. Each 10°C increase in operating temperature shortens motor life by 50%. Bearing temperature monitoring can indicate problems related to fluid-film bearings, including overload, bearing fatigue, or insufficient lubrication. FanMon™ provides monitoring for each bearing and motor winding temperature sensor.

Gas monitoring

Carbon Monoxide or LEL Propane or LEL Natural gas monitoring is normally utilized with mine heating applications in cooler climates. FanMon™ sensors can both monitor and provide safety-shut down interlocks for the heater control system.

Avoid air recirculation

Duplex primary fan applications require monitoring of the back draft dampers while underground booster fans require airlock door monitoring to avoid expensive air recirculation. A quick decline in fan pressure accompanied by an increase in airflow is indicative of a short circuit while a simultaneous rapid fall in pressure and airflow suggests a problem with the fan itself.

FanMon™ can monitor these conditions by utilizing proximity switches to indicate damper or door closure, differential pressure sensors to indicate airlock leaks or airflow sensors to measure the amount of recirculation.

Technical Specifications

Communication

- Open communications protocol for easy connection to any PLC, SCADA, HMI, DCS or PC based system
- Standard Ethernet Modbus TCP protocol
- Optional Allen Bradley EtherNetIP™ protocol

Power Requirements

- 110 to 220 VAC, 50/60 Hz CUL General purpose power supply
- Less than 3 amps

Signal Outputs

- Four 4-20 mA configurable outputs for maximum vibration level (system scans all sensors for the highest value), Modbus registers, etc.
- Four configurable relay outputs for high bearing or stator temperatures, high or high/high vibration levels, low airflow or high gas concentration, Form C, 8A AC/ 5A DC rated
- Maximum vibration, high vibration level switch, bearing and stator temperature, airflow and air temperature along with any other analog or discrete inputs are all available through a digital register map

Physical Parameters

- Outside dimensions 12-1/2" W x 17" H x 6" D
- NEMA 4X / IP 66 enclosure rating
- -20 to +60° C operating temperature range

Sensor Input Options

- Two ultrasonic airflow sensors, sensor junction box and 75' sensor cables included
- Four or eight stainless steel accelerometer vibration sensors and 85' sensor cables included
- 4-20 mA input signal for fan rotational speed used for variable speed applications
- 4-20 mA input signals typically used for static or differential pressure monitoring
- Gas monitoring
- Ten RTD input signals for monitoring stator and bearing temperatures
- Discrete inputs for back draft damper or airlock door position, 120-240 VAC, can connect to dry contact relays or solid state output circuits

Software

- Configuration and vibration analysis software included
- 24 different objects can be monitored for vibration (example, inner raceway, outer raceway, rolling elements, fan imbalance, fan blades, etc.)
- 84 different frequencies can be simultaneously monitored for vibration.
- All objects can be trended with FanMon's™ date and time stamped, 30,000 point battery-backed internal memory.
- H-FFT, FFT or time domain vibration software tools
- Ethernet output allows the remote viewing of vibration equipment allowing a fan vibration specialist quick and simple remote analysis