SENSAPHONE®
REMOTE MONITORING SOLUTIONS

5 Ways Remote Monitoring Technology Can Extend the Life of Your Pumps

By now it is common knowledge that remote monitoring systems and call-out systems help prevent unexpected downtime. By monitoring pumping stations, you can get real-time alarms on failures, maximize your pumps' best efficiency points and reduce unwanted overflows and spills. Having a remote monitoring system reduces maintenance and travel costs because you don't have to constantly drive to remote sites and do manual checks to know that pumps are functioning properly.

Monitoring systems also safeguard you against countless fines from overflow and flooded wells, and reduce downtime and cleanup costs. If a pump were to fail, the call-out system immediately sends you an alarm so you can diagnose the pump failure and take corrective action to get your well back online before a spill occurs.

Managing a storm water or sewer pump station can be very challenging. Unexpected events such as fast moving storms, heavy rains, lightning, and power outages are unpredictable. During these times, an unexpected pump failure can make it difficult to take fast enough action to avoid a spill.

Modern pumping systems typically include alarming functionality, but there isn't always the budget to upgrade equipment or replace an entire system. Fortunately there are a vast array of sensors that can prevent high level alarms from happening in the first place, extending the life of your pumps and minimizing station downtime.

Predicting Equipment Failures

In theory, a well-designed pumping system should continue performing effectively for years. However, the reality is that many different operating conditions can cut a system's life short. A pump laboring under the handicap of a clogged intake, suction loss, or cavitation stresses parts of the pump and can cause it to fail prematurely. Bearing wear, dead head, dry pump, and impeller jams can all cause premature motor and pump failure, which can lead to overflows and station shutdown.

By integrating new sensors into your system and utilizing data logging functionality, you can perform predictive maintenance, prevent unscheduled shutdown and optimize your pumps Best Efficiency Point (BEP). And you can do these things without replacing your current equipment. This eBook discusses five ways you can get more out of your pumps and water/wastewater equipment using sensors and the latest remote monitoring technology.

PUMP FAILURES THAT CAN BE PREDICTED

- Bearing wear
- Dead head
- Dry pump
- Impeller jam
- Impeller erosion
- Pump imbalance
- Loose shaft
- Cavitation

#1: Monitor Vibration

Fortunately, critical and auxiliary pumping systems usually give hints they are damaged and about to fail. Every rotating machine has its own vibration characteristics, and when a part starts going bad, those characteristics change.

For example, if the seals or bearings on a pump begin to fail or if an impeller breaks, vibrating increases. Although this change wouldn't be noticeable to the human eye or ear, it's easily detected by a vibration sensor installed on the pump. The sensor "listens" to the pumps acoustics to detect imbalances, providing early warning of issues arising within the pump.

SENSORS ARE INSTALLED IN THREE EASY STEPS:

1. **Sensors are permanently attached to the machine by a magnetic mount or screwed in via the sensor's threaded mount**
2. **Hard-wired to a remote monitoring system**
3. **System is programmed to alarm and data log the information coming from the sensor**

TYPES OF VIBRATION

Very low frequency: Vibrations in the 30 cpm range can signal destructive system faults like vertical pump fluid lubricated bearing whirl.

Mid-to high-frequency: Vibrations in the 450-60,000 cpm range can signal drive motor or impeller failure.

Very high frequency: Vibrations above 300,000 cpm can signal pump cavitation, entrained gas and high pressure leaks. They also indicate incipient faults on bearings, casings, rotors and piping.

Vibration sensors measure the vibration velocity (e.g. severity of vibration) of a machine from 0-25 mm/s (rms) over the frequency range 10-1000 Hz. An output of 4 mA will correspond to 0 mm/sec (e.g. no vibration) and an output of 20 mA corresponds to 25 mm/sec (intense vibration).

Each vibration sensor communicates its frequency readings in real-time to the remote monitoring system. You set the system to "alarm" when an out-of-limit value is detected. This gives you time to take the action required to prevent catastrophic failure, secondary damage, and expensive downtime.

Many remote monitoring systems function as data loggers since they record and store all sensor data, which you can access and view at any time. When vibration sensors are integrated into your system, you capture vibration readings at set time intervals, which you can view in real-time and analyze for trends that indicate a failure is imminent.

#2: Monitor Pressure

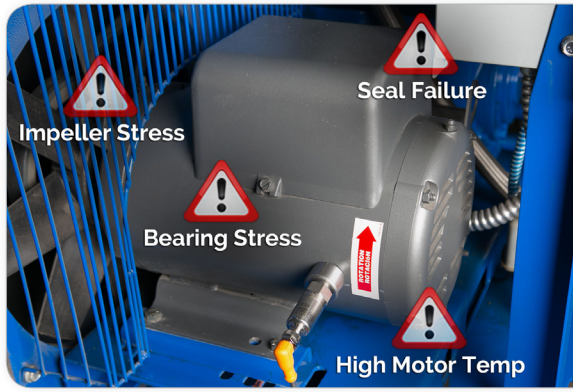
If you're running a pump, you have pressure. Monitoring this pressure is a key way to understand the characteristics of the pump and increasing its life cycle. The more flow you have, the less pressure you will see on the discharge; low flow will show a higher pressure on the discharge. Pressure sensors help you identify key problems that can prevent your pump from running within their BEP. Ideally a pump should not operate at flows ±10% of its BEP.

When a pump is not running at its BEP, motor temperatures rise, bearings, seals and impellers have more stress, which reduces their service life. All this can lead to premature failure of your pumping system. It is also useful to have a pressure sensor on the suction side; the difference in pressure is proportional to the total head. It's ideal to have pressure sensors on both sides of the pump.

In addition, pressure sensors monitor pump discharge, so they can alert if a pump shuts down for a long period of time or pressure drops from lack of suction. Pressure alarms let you take action to prevent the pumps from running dry if they lose suction for any reason.

Pressure sensors identify key problems that prevent pumps from running within ±10% of their BEP.

If your pumps are water cooled by an externally fed supply line, you can use pressure sensors to monitor these lines for adequate pressure. Water cooled pumps will go into a thermal overload if its temperature reaches unsafe levels, causing permanent damage to the motor, shaft, and impellor. So, low-cost sensors can prevent very costly repairs and unexpected downtime at your station.



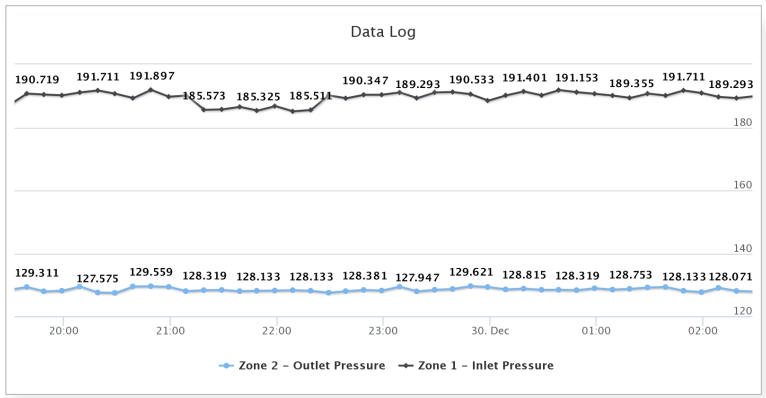
Remote monitoring devices can interface with the pressure sensor of your choice. For example, Sensaphone's 4–20 mA inputs will work with a vast array of third party sensors and provide real-time data acquisition so that you can log the well pressure data and have it accessible via the web interface at any time. This lets you run reports and analyze accurate data easily.

In wastewater applications, submersible pumps are typically placed at the bottom of lift station storage tanks to pump suspended solids, sewage and refuse. Pressure sensors can identify blockages and flooding so that operators can turn on additional pumps during flooding, equalize wear on pumps and turn pumps off when tanks are low.

#3: Monitor Current Amperage and Voltage

Remote monitoring systems can easily monitor for power failures, which obviously stop pumps and other equipment from running altogether. But you can go a step further by continually monitoring the pump's motor current, and use the results to determine if there is a looming problem. A pump running at overcurrent for a long period of time, even by small amounts of 5-10% their rating, will ultimately overheat, damaging internals and causing the pump to prematurely fail. An overcurrent state can also be caused by bad or failing bearings, clogged lines or material jammed within the pump.

Reduced flow caused by a blockage can also cause an undercurrent situation. In an overvoltage situation, current can increase and cause motor temperatures to run higher when the load decreases, causing a surge in voltage to the pump's motor. Similarly, if the voltage sags under heavier loads, the motor can suffer from a low-voltage state, which will increase the motor's current.



Remote monitoring systems monitor the pressure on the discharge and intake sides of the pump.

WHAT IS A CURRENT TRANSFORMER (CT)?

A coil that is inductively coupled to the AC input of the motor. It produces a signal that is directly related to the current used by the motor, and that signal trips an alert. The transformer can be quickly snapped around a motor wire and mounted in the same box used for motor wiring.

In any pump installation, the amount of current (amperage) the motor draws correlates directly to the size of the load. Adding a current transformer (CT) on the pump's incoming power will monitor the pump's current draw.

A severe increase or decrease as described above indicates a pump problem that requires immediate attention.

In pump installations, problems like suction loss and jams can cause serious damage to the motor or pump long before the thermal overloads trip. These problems can be detected within milliseconds of the occurrence by monitoring the drive motor current with a current transformer.

Wastewater treatment plants also use current transformer to monitor motor conditions at remote lift stations. The current data from each motor can also be trended and used to predict potential failures. In short, current monitoring can extend the life of any pump system.

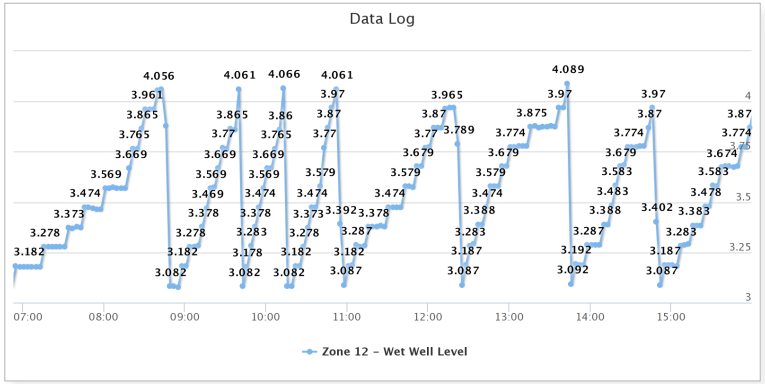
#4: Record pulse counts, run times and alarm logs.

Monitoring systems should be equipped with data acquisitioning functionality. This functionality automatically provides operating statistics and historical information on your pumps that indicates how well your station is performing. You can collect and record precise data, including flow rates, run times, and all the operational principals involved in pump monitoring. This data is available via a web interface, and can display in real time as the pump operates.

You can also configure flow meters with multipliers to determine how much flow a station is outputting. These values can be recorded and archived so you can create monthly and yearly reports.

Use run times for various data measurements including:

- Total hours a pump has worked
- How much accumulated time your station has operated per day
- Proper balancing work cycles on pumps



Remote monitoring system's dashboard shows total flow output from the pump in gallons from a pulse count flow meter. Dashboard was programmed with a 100x multiplier.

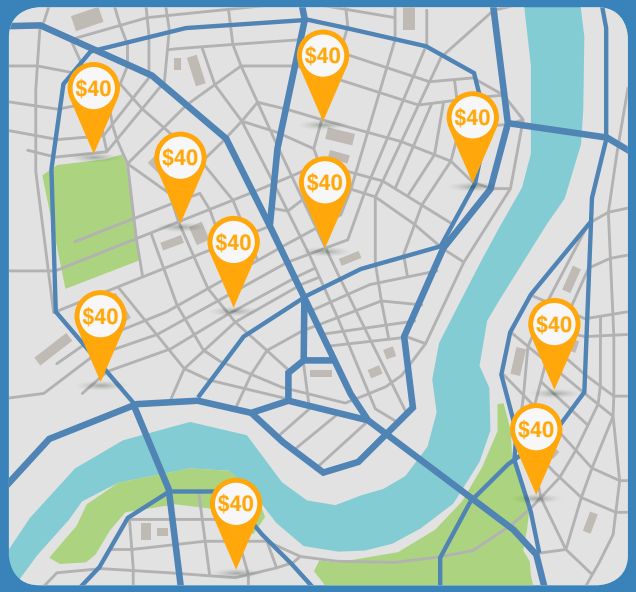
That way, when an inspector requires data, you can easily produce and export a run time reports. Other reports like Alarm Logs can be crucial tools to determine how much time your site was offline and when it came back online. Depending on the length of the downtime, penalties and fines occur most often when authorities determine that you didn't take fast corrective action to get the site back online.

#5: Switch to Cellular Service

Cellular-based remote monitoring systems can have a higher initial cost, but that cost is easily recovered with lower monthly rates. Cellular service costs far less than antiquated dialers using expensive copper phone lines. For each remote site you add, the reoccurring monthly cost on the landline is cut in half.

In addition, cellular systems are supervised. These systems will generate an offline alarm if the device unexpectedly stops communicating, which can be caused by a weather related event, a power surge, a mass outage or human error. With unsupervised land-line based systems, you can call in to verify the lines are operational. But a line can go down at any time after that check, rendering your pump station's alarm monitoring system useless.

Look for cellular systems that are cloud-based because they provide the greatest flexibility, redundant servers, real-time monitoring and data acquisition. Cloud-based cellular systems give you a full view of all your sites from a simple-to-use dashboard, as well as free phone apps to monitor on the go.



CELLULAR COST SAVINGS

Monthly savings is $400 by eliminating the land lines at 10 remote locations and getting cellular service.

It is vital to keep pumping systems and stations running as efficiently as possible. A remote monitoring system with integrated sensors can provide all the protection you need from high level events, and also enable you to conduct predictive care and maintenance. The right system provides a clear picture of energy use, equipment life-cycle and pump performance. It also uncovers fault trends to predict and diagnose pump failure, breakdowns and performance loss.

When production depends on early fault detection, sensor selection becomes critical. Sensors help you monitor vibration, pressure, current, pulse counts and runtime. Sensaphone has been providing sensors to the water and waste industry for over 50 years, and would like to put our experience to work to help you extend the life of your pumps.

Remote Monitoring Systems

- Predict equipment failures
- Provide an easy way to check on the status of conditions at any time
- Instantly inform you when conditions are less than perfect
- Detect environmental threats

Have Questions? Need Advice?

Talk with a Sensaphone remote monitoring expert today at **877-373-2700**, **contact@sensaphone.com** or visit **www.sensaphone.com/water-wastewater.**

About Us

Since 1985, Sensaphone® has designed and built its full line of innovative remote environmental monitoring systems and early detection products that quickly and effectively provide alerts to problems at your facilities. Over 400,000 systems are in use today around the world with the highest customer satisfaction rates in the industry.

Sensaphone is a family-owned business, and products are manufactured in the USA.

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