Condition Monitoring for Remote Pump Operations

Overview

Semaphore's T-BOX remote terminal unit (RTU) products are currently operating in many installations in which they monitor conditions and automate remote pumps in industries including oil and gas production and water and wastewater treatment.

While a description of pump and lift stations for the water and wastewater industries is available in a Semaphore case study ("Pump Station and Lift Station Operations," which can be accessed on the Semaphore web site, www.cse-semaphore.com), this description focuses on use with vibration velocity sensors.

The latest vibration velocity sensors provide valuable information on pump operations and maintenance. Pump condition monitoring measurements allow detection of bearing wear, cavitation, excessive flow rate, misalignment, and over-torque. The sensors are very easy to configure and require no knowledge of vibration analysis technology on the part of the user. Sensor I/O includes 4-20 mA analog interfaces and serial interfaces.

The sensors have been designed with many connectivity and data transfer features in order to work in practically a seamless manner with in-plant, distributed control systems. Since their rugged construction allows them to be used practically anywhere, how can operators of remote pumps best exploit the technology?

Semaphore's T-BOX IP/Web telemetry technology provides an excellent solution for remote condition monitoring. T-BOX cost effectively and efficiently provides timely notification of adverse conditions and allows operators to take action before expensive failures occur. The automation capabilities of T-BOX further allow immediate control actions, such as shutting down the pump that is experiencing problems and starting an alternate pump.
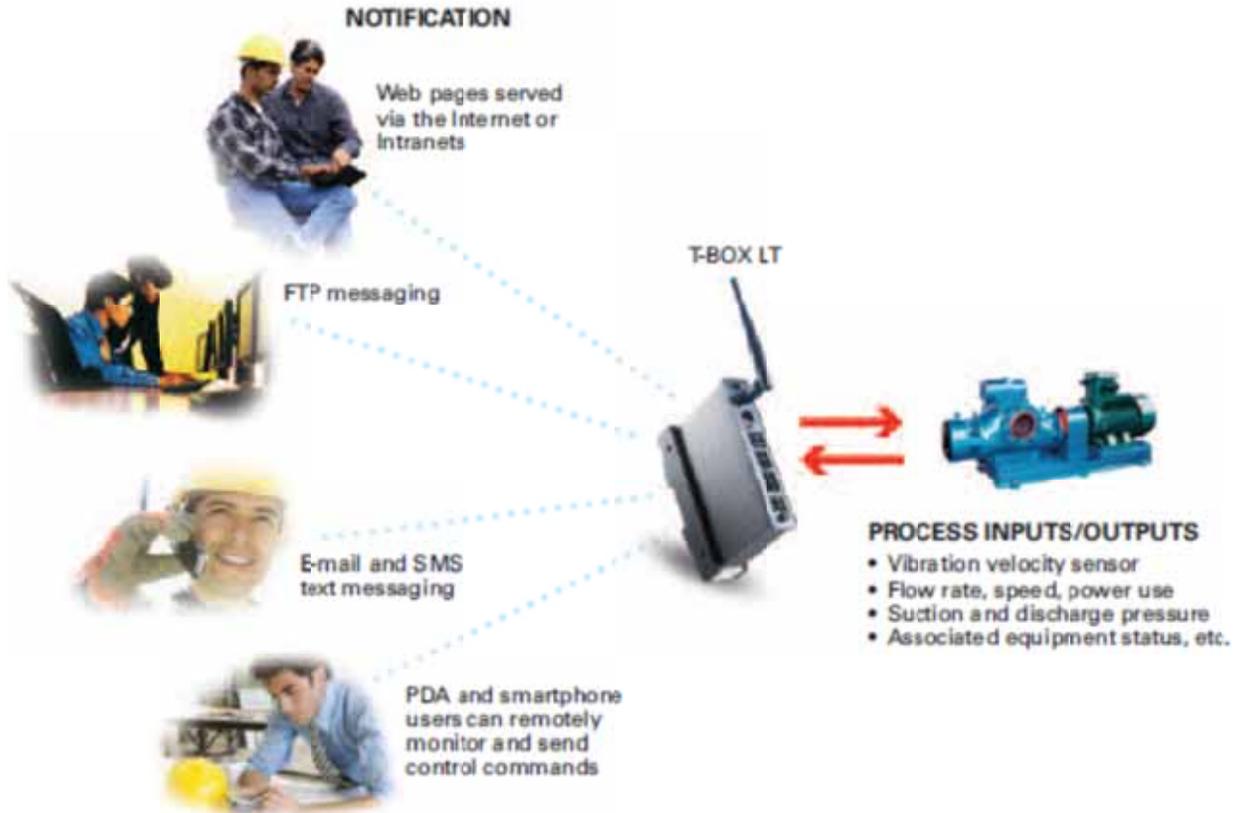
Instead of the continual polling that is characteristic of SCADA systems, T-BOX uses push technology to communicate when necessary. Push technology best utilizes inexpensive, public networks and allows remote sites to operate on the least expensive plans. At the same time, a T-BOX RTU can reside on a traditional, pull technology SCADA network using protocols such as Modbus, DNP3, and IEC 60870. Push technology can also be used to back up the traditional SCADA network in case of a communication failure.
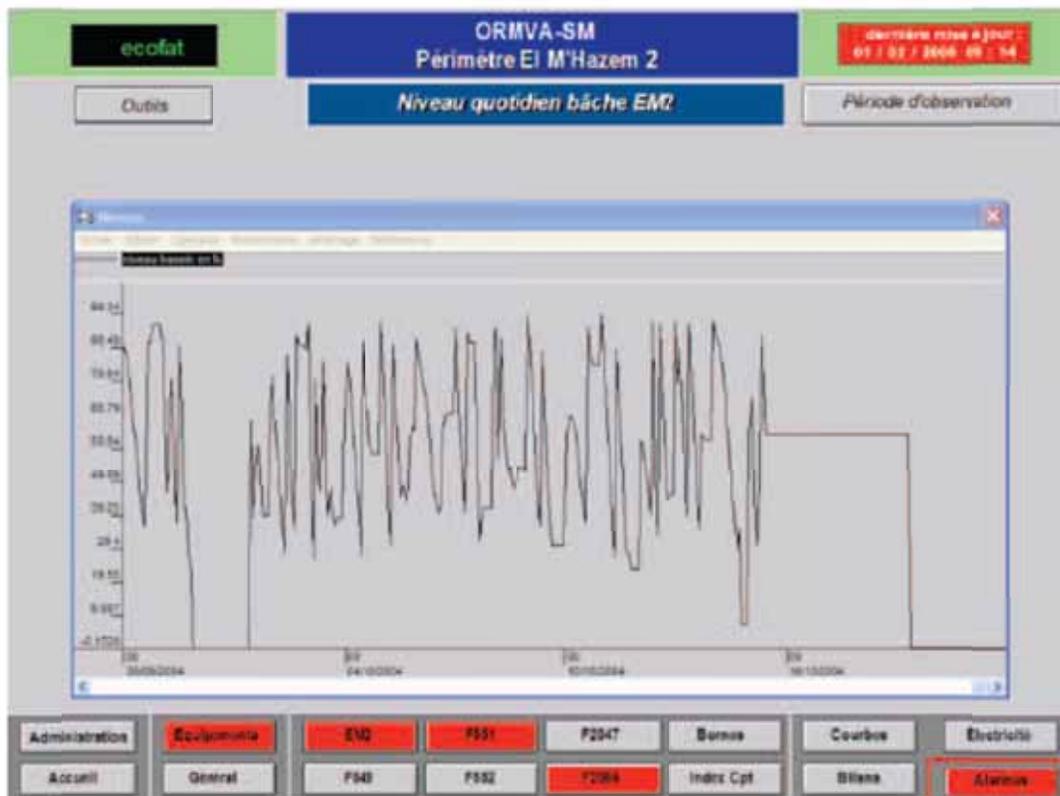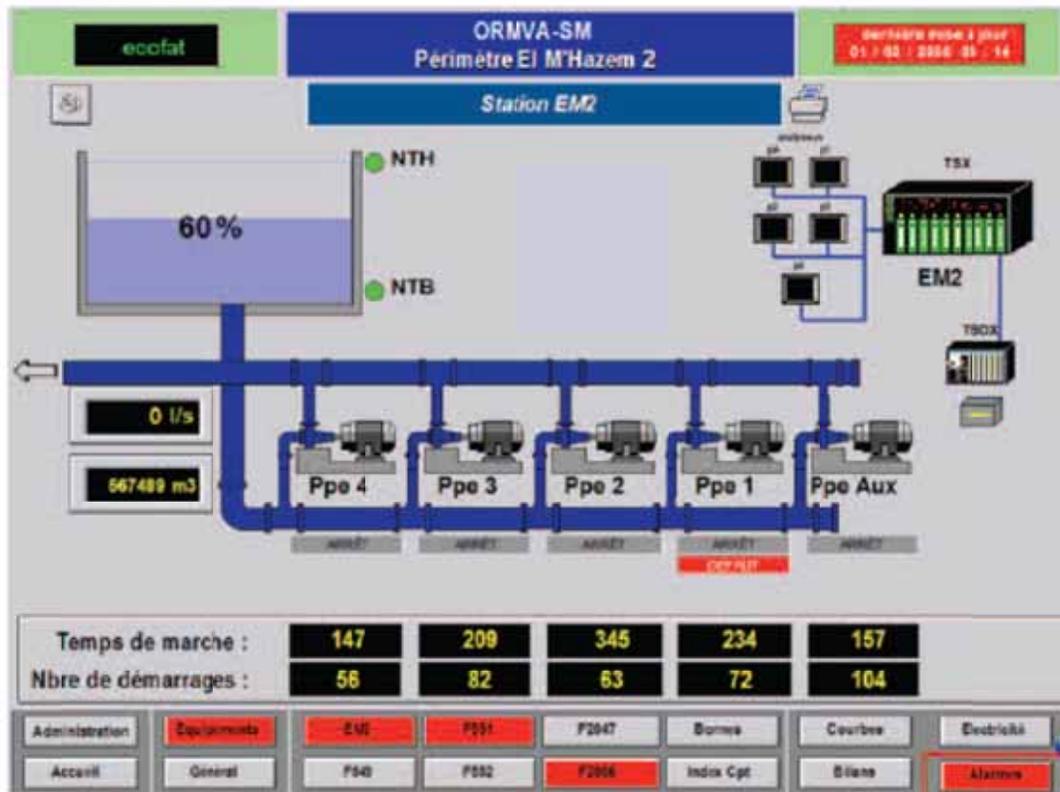
The T-BOX alarm management system informs operators of alarms or changing live conditions and can escalate reporting if acknowledgement does not come through in a user-configured time.

The T-BOX data-logging capabilities comprise another key requirement for remote pumps. T-BOX records historical logs, which can be viewed and transmitted in tabular or trend graph formats. The historical reports include a variety of information on site conditions and meet the requirements of regulatory agencies, when applicable, and record-keeping.

T-BOX further records operations information that is additional to the vibration inputs and can be used for maintenance purposes. Equipment run times and external conditions such as weather and ambient temperature are combined in maintenance reports and allow T-BOX to notify maintenance staff of an approaching milestone.

Historical information is also used for review by the engineering staff and has proven invaluable for modifying operations in order to increase efficiency and service life of the pumps. Using long-term, historical information as input, many systems employ scheduled operations, which are typically run over a week time frame. In such systems, T-BOX is programmed to anticipate loads throughout particular day types, including work days, weekend days, and holidays. By adapting to such loading, pumps run much more efficiently than they would with old techniques such as simply operating at constant speed.

NOTIFICATION

Web pages served via the Internet or Intranets

FTP messaging

T-BOX LT

E-mail and SMS text messaging

PDA and smartphone users can remotely monitor and send control commands

PROCESS INPUTS/OUTPUTS
- Vibration velocity sensor
- Flow rate, speed, power use
- Suction and discharge pressure
- Associated equipment status, etc.

CONCLUSION

For condition monitoring at remote pump installations, T-BOX:

- Monitors alarm conditions from vibration velocity sensors as well as flow, suction and discharge pressures, pump speed, power, temperature, and status of appropriate, associated equipment such as valves, tanks, wet wells, etc.

- Using programmable automation, performs actions such as starting/stopping pumps based on live conditions, starting second pump upon failure of first, and speed control. Increasingly, systems also include programming to operate pumps at their highest efficiencies based on live conditions.

- Via push technology, notifies multiple recipients of alarms and anomalies, live conditions such those provided by vibration velocity sensors, as well as valve-closed, low-tank, or wet-well level, etc.

- Escalates alarm reports if not acknowledged.

- Efficiently uses public networks and minimizes transmissions by sending reports via e-mail, SMS text, or FTP via IP only when required.

- Serves Web pages, which comprise a very low-cost HMI for depiction of live and historical information.

- Generates historical reports and trends, which are used for record keeping, system maintenance, and efficiency improvements.