kmo turbo

SLM - Smart Level Monitoring

Immediate detection of oil leaks
and accumulations of water in oil tanks

Immediate Detection of Oil Leaks
and Water Accumulations in Oil Tanks

The qualified operator...,

...used to control his machine regularly. Checking the oil system hourly he was able to detect even the smallest leakage and fixed it immediately. In times of drastic staff reductions due to automation, the disappearance of the human operator has adversely affected the quality of monitoring. In order to compensate for this, appropriate sensors and automatic monitoring must be provided. In terms of controlling a lube oil system SLM – Smart Level Monitoring® can meet this task.

The functions and benefits of SLM are to be pointed out with the monitoring of a lube oil system of a steam turbine. The main problems are oil leakages and water in oil.

Conventional Monitoring Methods

The monitoring functions of traditional concepts are limited to generating an alarm signal if one of the permanently fixed limiting values MIN or MAX is exceeded. This means an alarm is triggered only shortly before the tank runs empty or just before overflowing. Since the operator, who used to observe the oil level by taking a regular glance through the sight glass, is not on-site anymore, the whole range between MIN and MAX is not monitored.

Problem with "WATER IN OIL"

For instance, if steam condensate accumulates in a lubricant circuit there may already be massive damage on the bearings long before a permanently fixed MAX-alarm is triggered.
The operator used to be able to detect water in oil by regularly draining the tank, by inspecting for foam, or by inspecting for changed colours of the oil. Only in an advanced stage he was able to detect it from the level gauge. Without depending on visual indication SLM detects the smallest intrusion of unwanted fluid solely by measuring the increase of level.

Conventional methods of detecting water in oil haven't proved to be feasible in practice. They are mostly based on the natural separation of water and oil. As a result of continued circulation in the tank water and oil form an emulsion; therefore these methods cannot provide persistent reliability.

Problem with "OIL LEAKAGE"

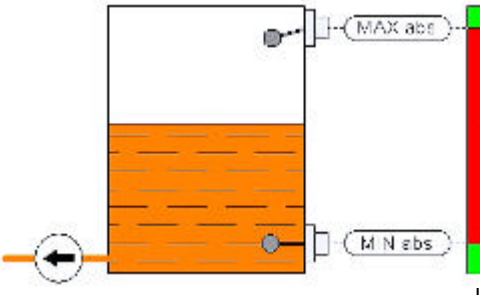
The careful operator used to find and fix even a small leak immediately. Without him a leakage is usually detected by the response of the permanently fixed MIN-alarm. In numerous cases this is too late to take adequate countermeasures:
The oil pump starts to draw air instead of oil and the machine switches off due to insufficient oil pressure. Even if the bearings stay undamaged, financial damage caused by cleaning effort and loss of production is inevitable.
In the worst case there can be bearing damages even before the MIN-alarm is triggered:

With a reduced amount of oil in the tank the oil circulates more often and is degassed insufficiently. As a result the efficiency of cooling and lubricating is diminished significantly. Whereas conventional methods of detecting a leakage are limited to provid-ing a permanently fixed MIN-alarm, SLM helps to avoid damaging effects by signalling even a minimal loss of oil.

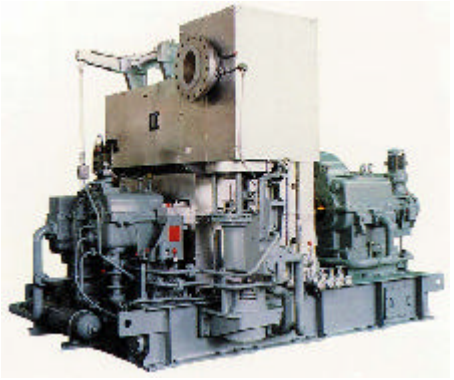
The basic principle of SLM is ingeniously simple:

It is based on monitoring limits which are adapted to the normal change of level according to the current operating condition of the machine and its oil system. Just as the operator used to distinguish between an operating level and a non-operating level, SLM takes all relevant operating states of the machine into consideration.

Conventional monitoring methods:



Smart Level Monitoring - **SLM**



Typical operating conditions which influence the level in the lube oil tank:

- oil circuit stopped (pipes are emptied into the oil tank)
- oil system in standby (pipes are filled with oil; oil temperature clearly below operating temperature)
- machine running (oil at operating temperature)

The duration of predictable level decrease is recorded as a control parameter. With each start of the oil pump dynamic limits are adapted to the changing oil level corresponding to the parameterized duration of the normal decreasing process. From reaching this new constant level SLM sets narrow limits for atypical level changes. Even minimal changes are detected and signalled immediately.

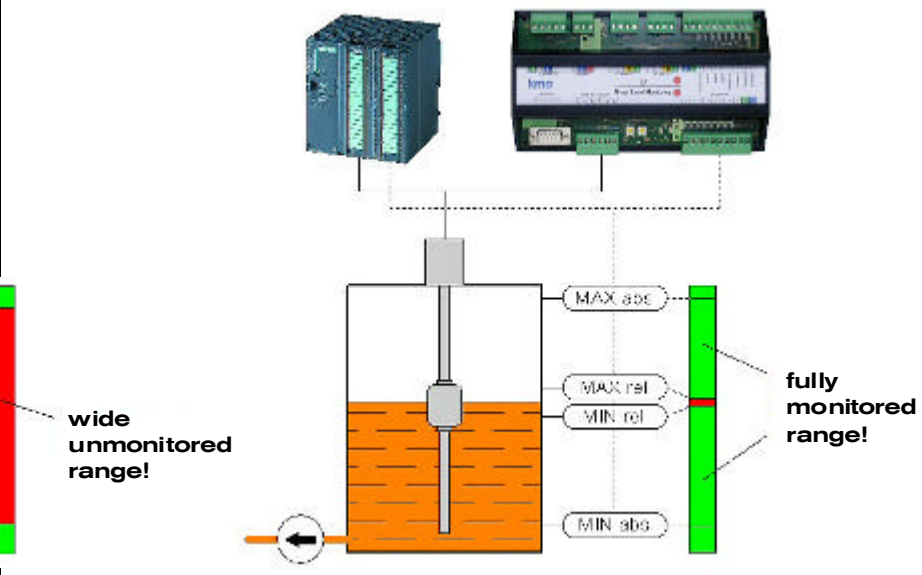
Parameter Setting and Configuration

At the initial commissioning of the machine a complete level profile is determined: Starting out from a constant level in the tank the oil pump is started. Due to the filling of the pipes the oil level in the tank decreases for several seconds until it reaches a new constant level. This regular change of level may not cause an alarm.

Comparable parameters are determined and entered for all operating conditions that cause a typical change of level.

At the initial commissioning the influence of the oil temperature on the level is determined and automatically compensated for. SLM monitors not only level limits but also the gradient (rate of level change). The response of this limit, which is signalled separately, indicates a “big leak”.

Smart Level Monitoring with
Simatic S7 or SLM control unit:



Level Transmitter

Each customary level transmitter such as floater transmitters, differential pressure transmitters, displacement level transmitters, capacitive/inductive measurement systems, radar or ultrasonic level transmitters can be connected to SLM.

Even the widely spread resistance tapes which conceptually only have a low resolution capability can be connected and analysed. However, in order to make effective use of the full monitoring potential, a transmitter with high resolution should be used.

In many cases differential pressure transmitters are used for level measurement. This normally quite reliable method fails, if for example, mud accumulates at the bottom of the tank and blocks the impulse line. In every respect, especially concerning the retrofit of machines, level measurement using a floater transmitter in accordance to the magnetostrictive method has always proved reliable.

The basic principle of SLM is applicable **to any physical and calculated value**

Innumerable Applications

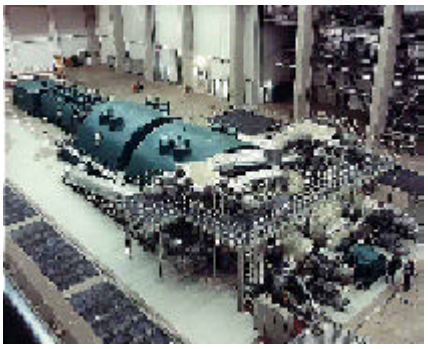
The basic principle of the automatic control presented here, is the monitoring of comparative dynamic limits. SLM, Smart Level Monitoring, is only one piece out of the mosaic of many conceivable applications. With the same method any physical value and even calculated values can be monitored with preference for practical needs: for example the loss of pressure in a reactor, the temperature difference of a heat exchanger, the degree of salination of a turbine, the efficiency of a machine, ...

The advantage is that troubles are detected without delay and not only after exceeding permanently fixed limits. Many times a trouble can only be connected with the cause usefully and instructively, if it is signalled immediately.

Control Unit

SLM is available as a ready-to-use, standalone monitoring unit, as well as a SIMATIC S7 function module.

Exemplary case No. 1: Steam Turbines and Vapour Compressors



Nearly all steam turbines and vapour compressors sooner or later are affected by it: steam from the environment of the machine gets into the lube oil system through insufficiently closed rotor sealing gaskets. Consequences: exchange of the complete tank filling, extensive cleaning and rinsing work, defective bearings, loss of production, etc.

Solution: SLM detects the intrusion of steam condensate at a very initial stage – long time before severe damage occurs.

Exemplary case No.2: Underground Funicular Accident at the Kitzsteinhorn in Kaprun / Austria

On November 11th, 2000, 155 humans lost their lives in the most tragic cable railway accident in the history of Austria. Approximately 50 litres of hydraulic oil ran out unnoticed for several days before a fire broke out. The oil was ignited by a defective heater which also led to the blocking of the brakes and stopping the train in the middle of a tunnel.

Solution: SLM already detects the loss of a few cubic centimetres of oil.

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