

ADAM and SIPLUG

Valve and Drive Online Monitoring and Diagnostics

ADAM® and SIPLUG® reduce maintenance costs and support safe and reliable plant operation.

Challenge

Proper design-based valve and actuator operation is a key factor for the safe and reliable operation of nuclear power plants. According to the World Association of Nuclear Operators, valve issues are the leading cause of forced plant outages. Valve repairs can be expensive, especially for contaminated valves, and the availability of long lead time spare parts or obsolete parts can cause difficulties. To mitigate the number of valve issues, significant efforts have been undertaken to implement predictive maintenance concepts based on costly and intensive recurrent in-situ testing of the valves and drives.

Solution

The application of the valve and drive online monitoring and diagnostic system ADAM/SIPLUG supports safe and reliable plant operation and paves the way to a cost-effective condition-based maintenance strategy implementation.

A SIPLUG module, permanently installed in the motor control cabinet (MCC), is able to record different electric values like active power or switch signals, during the normal operation of the assigned valve. The SIPLUG module is designed for installation in the cable outlet area or inside a feeder of a switchboard. SIPLUG consists of a compact sensor module and a put-on controller module on top.

Using the 64-bit software ADAM, each valve operation is automatically evaluated and assessed. Especially for safety-related and operation-related valves this provides valuable information on component condition to ensure proper function and contribute to optimization of maintenance strategies as well as effective maintenance execution.

For monitoring of solenoid valves (SOV) another type of SIPLUG sensor is available which supports the assessment of the dynamic and electrical behavior of SOV by measurement of voltage and current.

SIPLUG is qualified according to IEEE and KTA (1E separation, seismic integrity, high voltage, EMC, radiation and climate).



SIPLUG combined sensor (lower part) and controller module (upper part)

Customer benefits

Usage of the ADAM/SIPLUG technology allows:

- Continuous verification of functional behavior of valves and actuators during normal operation of the plant
- Optimized outage times based on knowledge of the current valve and actuator condition
- Early detection of changes or irregularities in functional behavior
- Allows post-fault analyzing – if something happens, it is recorded
- Reduced maintenance costs (cost savings per testing and valve of about € 5,000) and minimization of personnel dose rate

Your performance
is **our** everyday **commitment**

Technical information

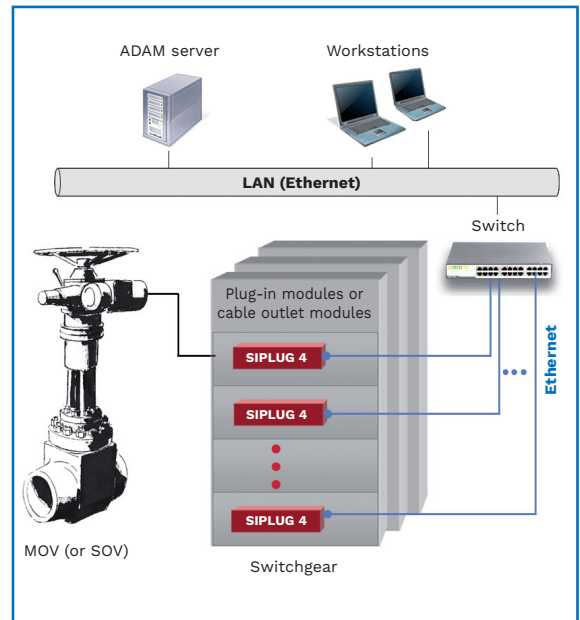
Principle

The relationship between mechanical torque and the active power shows a linear characteristic in a wide range. A baseline or calibration measurement provides the mechanical parameters in relationship to the electrical parameters of the actuator and the valve.

Together with the results of a calibration measurement, the accurate active power measurement of SIPLUG performed at the electric switchgear (MCC) can be used for calculation of the mechanical parameters like torque, thrust, friction.

System features

- Continuous remote monitoring with internal data storage and online transfer to a server
- Automatic online analysis and event monitoring (trend analyses and visualization of condition of valves and actuators)
- Reduction of costs of plant in-service testing from € 5,000 to under € 5 per test and valve
- Active power measurements following KTA 3504 and diagnosis with respect to the US NRC Generic Letters 89-10/96-05
- Full galvanic isolation of all input signals
- High sampling rate for enhanced data analysis
- Ethernet interface for fast data transfer
- Small size (91 x 85 x 85 mm plus terminals (15 mm)) and total weight (less than 1 kg)
- Range of operating temperature +5°C up to +40°C and a maximum relative humidity of 80% (non-condensing)
- Unique module identification, automatic detection of the current range, EEPROM for calibration data and valve identification
- Native 64-bit Windows software ADAM with support for Windows 10



ADAM / SIPLUG measurement structure

Key figures

More than **7,000** valves monitored with SIPLUG

5 different current measurement ranges (5 A, 10 A, 20 A, 50 A, 100 A) available to ensure highest measurement accuracy of < 1% of the full measurement range (typical 0.5%)

20 kHz sampling rate per channel stored as raw data allows supplemental analysis (for example, Fast Fourier Transform)

References

Western Europe

- Finland (EPR reactor)
- Belgium (PWR)
- Netherlands (PWR)
- Spain (BWR)
- Switzerland (PWR)
- Germany (PWR and BWR)

South America

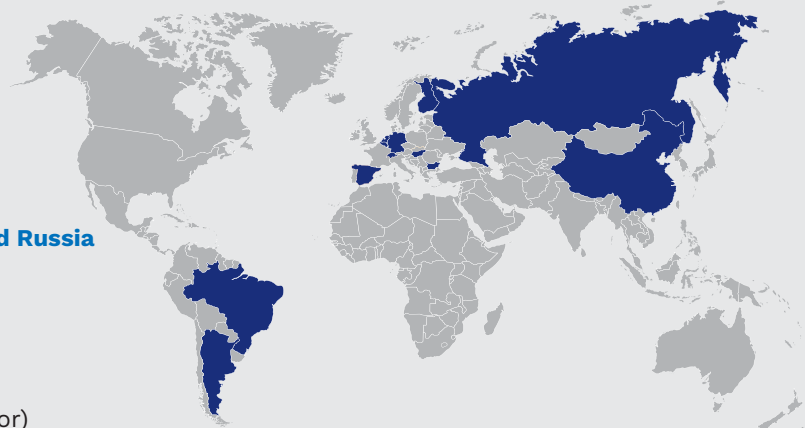
- Brazil (PWR)
- Argentina (PWR)

Eastern Europe and Russia

- Russia (RMBK)
- Bulgaria (VVER)
- Hungary (VVER)

Asia

- China (EPR reactor)



PWR: pressurized water reactor

BWR: boiling water reactor

VVER: water-water power reactor

RMBK: high power channel-type reactor

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