

SIPLUG4

Valve and Drive Online Monitoring

SIPLUG[®]4 reduces maintenance costs and supports 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 failures 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. Lost plant revenue is a common result of unplanned outages. To mitigate the number of valve failures, 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

Valve and drive online monitoring with SIPLUG4 supports safe and reliable plant operation and paves the way to a cost-effective condition-based maintenance strategy implementation.

A SIPLUG4 module, permanently installed in the motor control cabinet, is able to record various electric values like active power or switch signals, during the normal operation of the assigned valve. The SIPLUG4 module is designed for installation in the cable outlet area or inside a feeder of a switchboard. SIPLUG4 consists of a compact sensor module and an attached controller module on top. Each valve operation is automatically recorded. The component condition is key to valuable information, especially for safety-related and operation-related valves. This ensures proper function and contributes to the optimization of maintenance strategies as well as effective maintenance execution.

For monitoring of solenoid valves (SOVs) another type of SIPLUG4 sensor is available which supports the assessment of the dynamic and electrical behaviour of SOVs by measurement of voltage and current.

SIPLUG4 is bundled with the proprietary software “SIPLUG Explorer” which is used for configuration of the measurements and for the download of recorded data. The recorded data is stored in text files which can easily be imported into third-party analysis programs.

SIPLUG4 is qualified according to IEEE and KTA (1E separation, seismic integrity, high voltage, EMC, radiation and climate).



SIPLUG4 combined sensor (lower part) and controller module (upper part)

Customer benefits

Usage of SIPLUG4 is key to:

- Continuous verification of functional behaviour of valves and actuators during normal operation of the plant
- Optimized outage times based on knowledge of the actual valve and actuator condition
- Early detection of changes/irregularities in functional behaviour
- Post-fault analysis: if a valve failure occurs, the related data 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

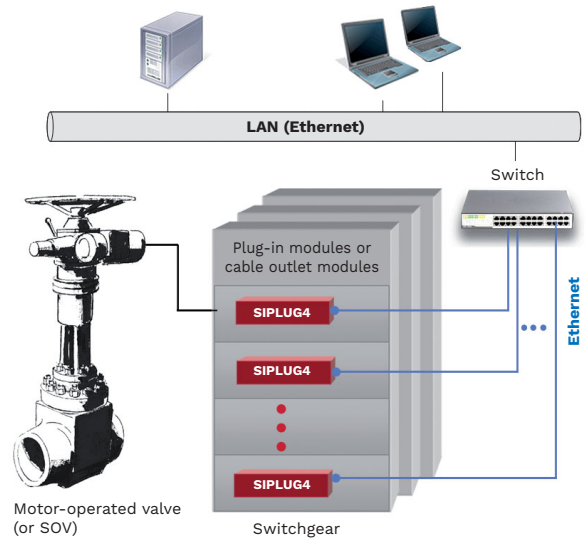
Technical Principle

The relationship between mechanical torque and active power shows a linear characteristic in a wide range. A base-line 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 very accurate active power measurement of SIPLUG4 performed at the electric switchgear can be used for calculation of the mechanical parameters like torque, thrust, friction etc.

System features

- Continuous remote monitoring with internal data storage and online transfer to a server
- Open data format (text CSV files) for import into various analysis software products
- Allows automatic online analysis and event monitoring (trend analyses and visualization of condition of valves and actuators) (additional software required)
- 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 and weight (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



Possible SIPLUG4 measurement structure

Key figures

Over **7,000** valves permanently 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 less than 1% of the full measurement range (typical 0.5%)

20 kHz sampling rate per channel stored as raw data allows supplemental analysis (e.g., fast Fourier transform)

References

South America

- Brazil (PWR)
- Argentina (PWR)

Western Europe

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

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 energetic reactor RMBK: high power channel-type reactor

Contact: monitoring-and-diagnostics@framatom.com
www.framatome.com

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