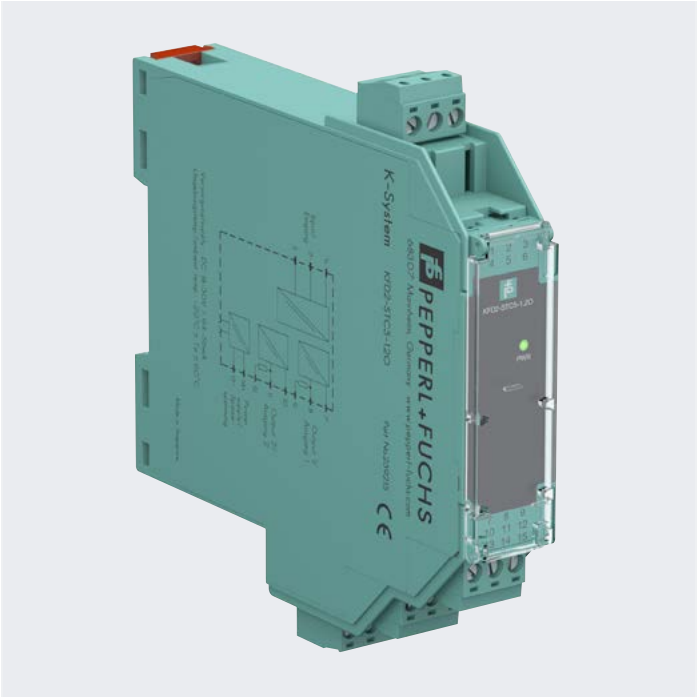
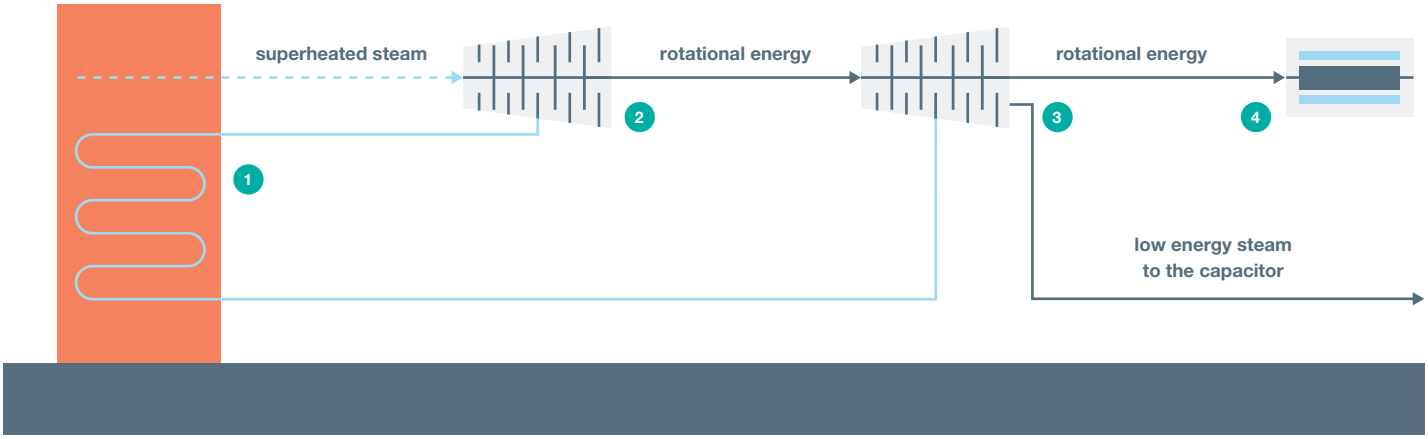
Generating Electricity in Coal-Fired Power Plants

Monitoring and control of turbines and generators



Application

The role of steam turbines in a coal-fired power plant is to convert the energy from the hot steam generated by the boiler into rotation energy over several stages. The steam that is generated by the boiler first passes through the high-pressure turbine, where it cools down, then enters the reheater. The steam is heated back up in the reheater and flows through the intermediate pressure turbine into the low-pressure section. The generated rotation energy is transferred via a common shaft to the generator, which then converts it into electrical energy. To ensure there are no disruptions, turbines and generators must be monitored reliably, and secure signal transmission between the plant and control room must be guaranteed.



Schematic process in a coal-fired power station, turbine and generation section

1. **Reheater**
2. **High-pressure turbine**
   Measured value: rotational speed, oil pressure, oil delivery volume, oil temperaturae
3. **Medium- and low-pressure section**
   Measured value: rotational speed, oil pressure, oil delivery volume, oil temperature
4. **Generator**
   Measured value: rotational speed, oil pressure, oil delivery volume, oil temperature

Goal

The lubrication system for the shaft connecting the turbine and the generator is monitored for optimum oil pressure and flow rate to prevent material damage as a result of an inadequate layer of oil. A decreasing viscosity caused by excessive oil temperature will have similar consequences. In addition, the rotational speed must not exceed certain trip values, as the resulting centrifugal forces will damage the turbine and generator.

Benefits

K-System interface modules, which feature galvanic isolation and deliver functional safety up to SIL3, transmit signals between the turbine/generator system and the control room without any interference. Signal conditioners for use in the safe area monitor the rotational speed of the turbine and generator to ensure it is correct. They monitor the pressure and delivery rate in the oil pumps, as well as the oil temperature.

Solution

Using frequency converters to measure the rotational speed of the turbine and generator is crucial for power plants to enable early detection and prevention of damage caused when the number of revolutions is too high, and for failure to reach the permissible line frequency when the number of revolutions is too low. Temperature converters with trip values for thermocouples, potentiometers, and resistance thermometers are available to monitor the oil temperature. Transmitter supply devices are used to monitor the oil pressure and the oil flow rate through the pumps.

At a Glance

- Frequency converters prevent the turbines and generator from reaching critical rotational speeds.
- Temperature converters with trip values for thermocouples, potentiometers, and resistance thermometers make it possible to monitor the temperatures in the bearings of the shaft connecting the turbines to the generator.
- Using transmitter supply devices to monitor the flow rate in the pumps ensures optimum oil pressure.

More information at
www.pepperl-fuchs.com/signalconditioner-k-system