Busbar Temperature Monitoring in Switchgear Cabinets

with Calex Infrared Temperature Sensors
The temperature of electrical connections in power distribution systems is an important indicator of their condition. As connections degrade and fail, their resistance increases and their temperature can rise, causing further damage and a potential fire or explosion risk.

Most large industrial sites have a room containing the electrical switchgear, transformers and panels that distribute electricity around the site. Faults in this equipment can develop gradually over a long period of time, or very quickly in case of the sudden failure of a component. To prevent costly downtime and help plan preventative maintenance, it is crucial that temperatures are continuously monitored.

Calex non-contact infrared temperature sensors, in conjunction with a centralised monitoring system, are an ideal way of measuring these temperatures. They provide an accurate, instant reading of the surface temperature of the conductor, while remaining physically isolated from the voltage it carries.

The PyroMiniBus sensor is ideal for switchgear applications where the available space for mounting the sensor is limited. It withstands ambient temperatures up to 120°C, and can measure object temperatures from -20°C to 1000°C.

**Measuring the Temperature**

Inside the switchgear cabinets, power is transferred by copper busbars that are bolted together at connections. This is the area most susceptible to failure.

The first symptom of deterioration is an increase in joint temperature, which can be detected quickly by continuously monitoring the temperature of each joint using low-cost IR temperature sensors mounted permanently inside the switchgear cubicles. The surface of the busbar should be painted, coated or shrinkwrapped at the measurement location to make it non-reflective. This makes it extremely easy to achieve accurate temperature measurements.

![Diagram of temperature measurement](image)

The sensor is positioned at a safe distance from the busbar to avoid the risk of an electric arc, and will measure the surface temperature within a small spot. The size of the measured spot depends on the chosen optics and the measurement distance.

At short distances, the wide-angle 2:1 optics may be best suited; for higher voltages, narrower 20:1 optics allow a much longer measurement distance to be used for a given busbar width. Focused optics are available for measuring narrow busbars, or for measuring thicker busbars edge-on.
Temperature Monitoring Systems

General-purpose PyroMiniBus sensors and local displays provide temperature measurement and display functionality. They can be incorporated into a switchgear temperature monitoring, alarm and data logging system.

Sensors

PyroMiniBus sensors have RS485 Modbus RTU communications, and can be connected directly to a Modbus Master, or optional local displays. The sensor body is made of 316 stainless steel to maximise shielding from electromagnetic interference.

Local displays

With optional PM180 6-channel touch screen terminals positioned close to the sensors, maintenance engineers can quickly and easily locate the high temperature reading.

The PM180 provides local temperature display, sensor configuration, data logging to MicroSD Card, and on-screen alarm indication. Alarm outputs are available locally via a connected module. The PM180 may in turn be networked with PM180 units in other switchgear cabinets.

Measuring Many Locations

Optional Calex Panel PCs, with Windows Embedded, are capable of running software to display temperature data from multiple PM180 sub-networks, or from groups of sensors connected directly. Each panel PC can display temperatures from all the sensors in a switchgear room, and the panel PC’s Ethernet interface allows real-time access to the data.

Centralised SCADA

Sensors, PM180 units and Panel PCs can be connected to an external Supervisory Control and Data Acquisition (SCADA) system, or a Building Management System (BMS). It is possible for an entire power distribution network to be monitored centrally using third-party software.

Example Layout

Measurement Angle

When measuring painted surfaces, the angle of the sensor relative to the surface does not usually affect the measurement accuracy. This is because non-reflective surfaces emit infrared radiation relatively evenly at a wide range of angles.

Please note: when measuring at a 90-degree angle, the measured spot is circular, and at lower angles it is elliptical.

Alternative Sensors

Sensors with other output types, and sensors for ambient temperatures up to 180°C, are also available. Contact Calex to see how we can help you choose a sensor for your application.